



## Bacterial disease resistant derivative of Samba Mahsuri recommended for release as a variety by ICAR

IN a collaborative project, the Centre for Cellular and Molecular Biology (CCMB), Hyderabad and the Directorate of Rice Research [a constituent laboratory of the Indian Council of Agricultural Research (ICAR)] have introduced three genes for bacterial leaf blight (BLB) resistance into the elite fine grained rice variety, Samba Mahsuri using molecular marker assisted backcross breeding. This rice strain, called **RP BIO 226 (IET 19046)** is a near isogenic line containing the BLB resistance genes, *Xa21*, *Xa13* and *Xa5* in the genetic background of Samba Mahsuri.

**RP BIO 226** has successfully undergone national level field trials under the All India Coordinated Rice Improvement Project of ICAR. It has been found to retain the yield as well as excellent grain and cooking quality of Samba Mahsuri and, in addition, is resistant to BLB which is a serious disease. Because of the above, it has been recommended for release as a variety by ICAR during the 42nd All India Rice Research Group Meeting held recently in Hyderabad.

**RP BIO 226** is found to be suitable for BLB endemic areas of Southern, parts of Eastern and Western zones of India where BLB susceptible fine-grained varieties like Samba Mahsuri, Sona Mahsuri, etc. are grown. Samba Mahsuri, which was originally developed by the Acharya N G Ranga Agricultural University in Andhra Pradesh, currently occupies 3.3 per cent of the area under rice cultivation in India and is grown in five states (Andhra Pradesh, Karnataka, Orissa, Chhatisgarh and Uttar Pradesh). Samba Mahsuri is in great demand in the market place and commands a very high premium price in comparison to other varieties. Because **RP BIO 226** is equivalent in yield and grain and cooking quality, it could serve as a replacement for Samba Mahsuri in BLB endemic areas.

This is one of the first examples of a rice variety product developed in India through biotechnology that is approved for commercialization.



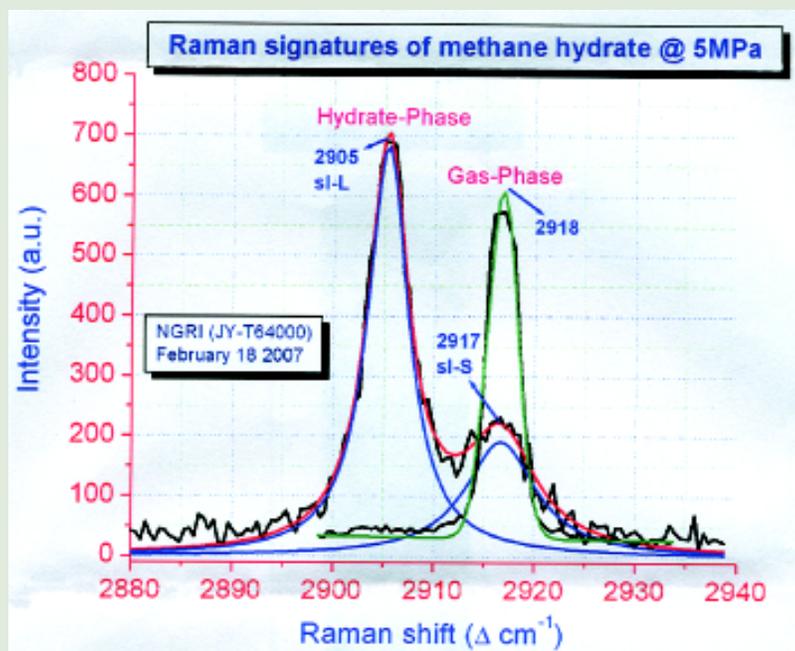
### NGRI probes Synthetic Gas Hydrates by Micro-Raman Spectroscopy

**G**AS hydrates are non-stoichiometric ice-like solids, constituted by cage-like structures formed by a skeleton of hydrogen-bonded water molecules hosting the guest molecules such as methane in abundant quantity, often found along the continental margins. Understanding the formation, stability and structure of these hydrates, in particular methane hydrates, is a burning issue in many industrial and research laboratories worldwide. Raman spectroscopy has been recognized as a versatile tool for probing the gas hydrates in various structural states.

The National Geophysical Research Institute (NGRI), Hyderabad, is actively involved in the scientific programme on Gas Hydrates, launched by the Ministry of Earth Sciences. The institute is pursuing Geophysical data processing, interpretation and laboratory studies. A state-of-the-art facility for Laser Micro-Raman Spectroscopy has been established and small volume high-pressure reactors have been indigenously fabricated.



"Burning ice" — Methane Hydrate synthesized at NGRI



Using these facilities methane hydrates have been synthesized and characterized for the first time in the country by NGRI. Observed Raman band at  $2918 \text{ cm}^{-1}$  is the characteristic feature of methane gas, whereas the bands at  $2905$  and  $2917 \text{ cm}^{-1}$  are typical of methane hydrates in structure-I. Using Micro-Raman Probe one can establish the presence of gas-hydrates in naturally occurring ocean bottom sediments. Such work so far is being taken up only in some leading laboratories in USA, Canada and Japan.

## CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE

### R&D Highlights

**T**HE Central Food Technological Research Institute (CFTRI), Mysore, continues to pursue a large number of in-house, network, grant-in-aid and industrial projects. A brief account of R&D highlights during 2005-06:

Shelf stable Brown rice (Nutri-rice), which could be stored for 6-8 months at room temperature, has been obtained from hydrothermally treated paddy. Sensory evaluation of the stored nutri-rice has provided favourable indications about cooked Nutri-rice in respect of texture, aroma and other attributes. The Nutri-rice is found to possess better nutritional quality than milled rice. A versatile tiny rice mill that could shell and mill paddy of any variety, size and shape (including parboiled paddy), which can be useful in the tiny scale sector, has been designed, fabricated and tested. Moth bean, soybean, little millet, horsegram and pearl millet have been used in the preparation of ready-to-eat expanded grains. These products are crisp and crunchy with desirable aroma and taste. Expanded brown rice distinguishes itself by its high content of dietary fiber apart from antioxidants such as oryzanol. Expanded cereals and legumes are suitable as ingredients in health foods. Formulations and process parameters for the preparation of nutraceutically-enriched candy have been standardized. Hardboiled candy, fortified with ferrous iron and vitamin C is found to possess acceptable sensory attributes other than colour. A confectionery tablet, fortified with *amla* pulp powder, has been developed to exploit the health

benefits of *amla*. Products in which *amla* is incorporated moderately are found sensorily acceptable.

Studies have indicated that combination of preservatives can extend the shelf life of *chapati* and *parotta* by 7-8 days. Emulsifiers such as glycerol monostearate, sodium stearoyl-2-lactylate and lecithin improve the mixing characteristics of whole-wheat flour while alpha amylase causes dough breakdown. Fortification of whole-wheat flour and wheat flour does not significantly influence the dough properties of the flours up to three months of storage. Different preservatives and additives have been experimented for enhancing shelf life of *chapatis* prepared on a large scale. Attempts have been made to understand the influence of fortification of flour with minerals such as iron, calcium and vitamins on the rheological characteristics and bread making quality.

Thermal and hydrodynamic properties of individual oils, blended oils and interesterified oils have been worked out to identify suitable combinations for frying studies. Two coconut oil blends — one with rice bran oil and the other with sesame oil — have been assessed for their nutritional value in addition to their effects on serum and hepatic lipids in rats. Low temperature-low humidity method of drying is found

to afford better retention of colour in dry *oregano* leaves. Volatile profiles of essential oils from three samples of *ajowan* have been obtained. A simple process has been devised to isolate best purity thymol from *ajowan* oil. The antimicrobial activity of phenolic portion of *ajowan* oil is most effective followed by *carvacrol* and *oregano* oil (phenolic portion).

Oligosaccharides from cereal grains and pulse husks were found to be heterogenic in nature. *In vitro* enzymatic digestibility of three mushroom species — one each of high protein, medium protein and low protein (dry, powdered) — was studied. Incorporation of dry mushroom powder in biscuit formulation at a low level resulted in an acceptable product. Encapsulated cumin and oryzanol was found to decrease the lipid peroxidation in liver. High protein concentrates were prepared from sesame, soy and mustard seeds. Saponin content in soybean increased three fold on germination. Protein concentrates, enriched with iron from niger meal and high saponin soy milk powder, could find applications in functional foods. A protein hydrolysate was developed with potential to scavenge free radicals and also inhibit angiotensin-converting enzyme. Amelioratory influence of dietary fenugreek seeds



on cholesterol induced gallstone condition was evaluated in experimental mice. Dietary fenugreek significantly lowered serum cholesterol levels, serum LDL-cholesterol as well as hepatic cholesterol concentrations. A process that yields free flowing, fat enriched chocolate powder was standardized. Encapsulating ingredients, such as casein, maltoextrin, skim milk and whey powders were experimented with to obtain bakery shortening in powder form. Partial replacement of oil by suitable starch in the foods, without affecting oily mouthfeel of the product, was being probed.

Lactic acid bacteria cultures, along with 12 cultures obtained from culture collection centres exhibited probiotic properties such as tolerance of pH and bile salts, apart from antimicrobial activity. Phytase activity was found to be essential for the bioavailability of trace elements, while beta-glycosidase activity reduced glucose intolerance. Six cultures isolated from *kanjika* exhibited antimicrobial activity against *E. coli*, *B. cereus*, *L. monocytogenes*, *Y. entero-colitica* and *S. aureus* (FR1-722). Multifunctional proteins that inhibited angiotensin converting enzyme and exhibited free radical scavenging as well as antimicrobial activity, were isolated from alpha and k-casein, and were characterized and synthesized. Chilli pericarp powder was subjected to counter-current extraction with a selected polar solvent mixture in columns, arranged in a row, to obtain pungent

aromatic fraction before eluting the columns with nonpolar or ketotic solvents to get colour fraction. The pungent aromatic powder and colorant obtained by desolventizing the fractions were analyzed for total

integrated process for preparation of protein hydrolysate, recovery of carotenoids and extraction of chitin was developed. Effect of enzyme pretreatment of cumin on the extraction of volatile oil was investigated. The conditions of pretreatment, namely, enzyme dosage preconditioning and incubation time were optimized for a few enzymes. An improved unit for distillation of volatile oil from cumin was designed and a prototype fabricated.

A prototype of a sheeting, forming and frying machine for continuous production of traditional food, *poori*, has been designed and fabricated. The *vada*-making machine, developed earlier, has been modified to achieve fuel efficiency and reduction of oil consumption during frying. Studies on the texture of *vada* have indicated shear stress and stiffness to be good indices. *Makhana* processing has been surveyed to develop equipment and process for puffing *makhana* seeds.

Preliminary studies on dry blanching of *tulsi* have been done with infra-red and microwave radiations. The spouted bed roaster, designed to work on HTST principle, not only removes unwanted materials such as husk, dirt and dust, but also enables solid mixing, effective gas-particle contact, enhancement of aroma and flavour, retention of organoleptic and nutritional attributes, to yield the best product.

An integrated roaster has been devised, wherein roasting, resting and cooling take place in a single,

## Performance Indicators 2005-06

### Patents filed

In India	52
Abroad	70

### Publications

Research Papers	150
Reviews	22
Book Chapters	10
Papers in Proceedings	5

### Projects

Sponsored	16
Grant-in-aid	94
Consultancy	44

### Accomplishments

New Processes Developed	12
Technologies Transferred to Industries	76
Product Samples Analyzed	1455
Number of Technical Counselling	902
Number of Technical Enquiries	7079

### Human Resource Development

M.Sc. Students Passed Out	24
ISMT Students Passed Out	20
Number of Short Term Courses Conducted	24
Number of Ph.Ds Awarded	19

soluble solids and the colour content, respectively.

Parameters were optimized for biotransformation of potent cultures to obtain nutraceuticals from fungal cultivars. Tea polyphenol oxidase was found to be the best for conversion of catechin to theaflavins. Fermentation ensiling was found to be a better method of pigment stabilisation of carotenoid from shrimp waste than acid ensiling. An

compact machine, as an alternative to conventional sand roasting, with better energy efficiency.

Inactivation of peroxidase enzyme is found to be quicker in carrot slices compared to potato, under similar blanching conditions. Parameters for separation and purification of biomolecules from the crude extract of pineapple have been optimised. A technology protocol for packaging and transportation of pineapple of the north-eastern region comprising harvest maturity, post-harvest treatments that are nontoxic and non-residual, apart from a method of bulk packing in trucks on a commercial scale, has been developed and tried with significant reduction in losses. Extension of shelf life of *litchi* fruits by three weeks, with reduction in pericarp browning, has been achieved. Physical properties such as length, breadth, thickness, sphericity index and coefficient of friction, have been analyzed at two moisture levels of a maize variety. The germ-obtained from a commercial variety of maize milled in a horizontal abrasive polisher and a horizontal friction polisher, with and without water conditioning, has been evaluated. Number of finger millet cultivars have been evaluated for amylase content, popping and pasting characteristics. Functional properties of finger millet malt hydrolysate indicate the latter's suitability as a substitute to maltodextrin in specialty foods.

A process for the production of fructooligosaccharides (FOS) at 50 L level has been developed. A few products based on FOS, such as nature identical honey, prebiotic

spread, FOS powder and nutraceutical beverage concentrate have been developed.

The texture of liquid as well as snack foods has been investigated. A method to characterize various attributes such as stringiness and mass adherence that relate to rheological characteristics like yield stress and apparent viscosity, apart from sensory attributes, viz., stickiness and flowability has been developed for liquid foods. In case of solid foods, size of air cavities and thickness of cell wall appear to affect the texture of solid foods, markedly. The feasibility of in package thermal process and reduction of headspace oxygen in the package have been explored as two major hurdles against microbial growth and oxidation related spoilage in traditional Indian sweets.

Packaging and processing conditions have been standardized for *Laddu* and *Jahangir*, following heat penetration studies using different packaging and packing configurations. The effect of different solvents used in the extraction of oil from rice bran on the quality of the oil has been studied. Four organic solvents, two polar and two non-polar, have been used in the extraction in a soxhlet apparatus. The polarity of the solvent used for extraction appears to have a bearing on the quality of rice bran oil. Enzymatic pretreatment of cake with cell wall degrading enzymes has been studied with respect to its effect on oil yield and recovery. Process parameters have been optimized to obtain *tofu* (a soy curd) with good flavour, quality and texture. Suitable packaging material

that can enhance the shelf life of *tofu* has been identified. *Okara*, a byproduct of *tofu* preparation, rich in protein and amino acids has been tried as supplement in Indian traditional foods.

Molecular weight and degree of acetylation of native chitosan, purified by various criteria, were determined by FTIR and NMR to be 71 KDa and 26%, respectively. Lipases and hemicellulases exhibited non-specific chitosoanalytic activity. Of the various lipases screened, wheat germ lipases as well as *Candida cylindracea* lipases were found to be more efficient compared to other lipases. *Ragi* water-soluble polysaccharides had maximum inhibitory effect on pancreatic  $\alpha$ -amylase at 1% concentration. Water-soluble polysaccharides were found to contribute to the slow digestion of cereal starches by pancreatic  $\alpha$ -amylase. Chloroform extract of mango ginger, on fractionation, yielded a pure antioxidant compound.

Aqueous and methanol extracts by fresh and dry fruits of *Dillenia indica* were evaluated for total phenolic content, total antioxidant activity and antibacterial activity against a few foodborne pathogens. Methanoic extracts had higher total phenolics and antioxidant capacity than aqueous extracts. A new aqueous two-phase system containing polyethylene glycol and xanthan, developed along with its phase diagram, was employed for partitioning studies of bovine serum albumin. Aqueous two-phase extraction was found to be an attractive alternative for the



downstream processing of betalaines, mainly for the removal of sugars. A new, simple and efficient approach for the purification of C-phycoyanin was developed using aqueous two-phase extraction and ion-exchange chromatography.

Micropropagation protocol for *Coffea arabica* and *C. canephora* was developed. Triacantanol supplemented medium supported regeneration of plants from somatic embryos. Cloning of N-methyl transferase gene and making antisense and RNAi constructs for down regulation of coffee resulting in the development of low caffeine somatic embryo were achieved.

*Botryococcus*, an algal species, was found to be rich in antioxidant and bioactive compounds, whose food value is being ascertained, apart from hydrocarbons that can be transformed to biofuels. Seaweeds, *eucheuma* and *enteromorpha*, were processed and incorporated into a few food formulations. Enteromorpha-based snack foods had enhanced nutritional value in terms of iron, calcium, vitamins A, E and niacin. Seaweed samples were suitably processed to reduce microbial load to facilitate acceptability in food formulations. Microbiological analysis of treated and untreated samples of the two seaweeds (flakes as well as powder) showed the presence of standard plate count in all samples and the absence of coliform, yeast and mold in most of them.

PCR conditions for the isolation of enterotoxin gene were standardized, while plant tissue culture conditions for spinach and

carrot were under standardisation. Shoot cultures of *Nanjanagudu rasabale*, already established *in vitro*, have been used to develop a high rate multiplication medium for improved shoot number avoiding the possibilities, of epigenetic variations that occur during micropropagation. Tissue culture methods have been standardized to aid in obtaining variants and regenerate genetic transformants. PCR based procedures for the detection of regulatory taxon specific and transgenic sequences have been standardized for herbicide tolerant (round up ready) soya and insect resistant maize powders. Lateral flow strips from three commercial sources have been optimized for the specific detection of CP4EPSPS gene in herbicide tolerant soya, Cry IAb gene in insect resistant maize and Cry IAc gene in Bt cotton.

Methods have been optimized for isolation of total volatiles from the roots of *D. hamiltonii* and *H. indicus*. Chemical compositions of volatiles of both the species have been compared with reference to biogenesis, sensory and flavour characteristics. Processes have been developed for the preparation of radical scavenging conserves from the roots of *D. hamiltonii* and *H. indicus*. Flavoured tea, prepared with swallow root extract at different concentrations ranging from 15 to 22 ppm has been evaluated for flavour intensity and overall quality. Development of a stable, improvised prototype of tea biosensor using immobilized tyrosine enzyme has been completed. Black tea samples have been analyzed and the results

validated by total polyphenol estimation. Attempts have been made to adopt the fluorescence based dipstick method developed at IMTECH, Chandigarh to the chemiluminescence method developed at CFTRI. The excellent linear calibration of chemiluminescence response of various dilutions of atrazine labelled HRP indicate sensitivity of the biosensor to 0.1 ppb level.

cDNA sequence of rice bran lipase was elucidated towards developing an understanding of the structure of the lipase. A total of 17 (fungal) strains from the culture bank of CFTRI were screened for proteolysis activity. Extracellular protease activity was checked in moldy bran with special reference to acidic proteases. Bacterial strains from the culture bank were also screened for protease activity. *Bacillus* species showed the maximum activity under experimental conditions of growth. All the proteases were highly active in the neutral range pH. Process conditions, such as pH, temperature, time of hydrolysis and enzyme-substrate ratio, were optimized to obtain protein hydrolysate, using an alkaline protease, from the visceral wastes of fresh water fish. The major protease inhibitor specific gene was isolated from the genomic DNA of horsegram using amino and carboxy terminal specific primers. The expressed protein inhibited both trypsin and chymotrypsin.

Detoxification of the oilseed meals from tree borne oil seeds—*Jatropha*, *Karanja* and *Simarouba*—was investigated by roasting,

autoclaving, acid treatments, extraction with acid, alkali or ethanol, boiling with water and mild alkali or acid. Preliminary studies have indicated that *Karanjin*, a furano flavanoid isolated from *Karanja* seeds, possesses antiulcerogenic property.

The diabetic status of rats and amelioratory effect of banana stem as well as flower have been established by measuring relevant parameters in blood and urine. The formation of advanced glycation end products (AGEs) in diabetic rats and its amelioration has been assessed by the extent of fructosamine formation. Peptic polysaccharides and antioxidant fractions from ginger and swallow root have been evaluated for their efficacy employing *in vitro* biochemical and *in vivo* animal models. Redness, bloody streaks and bloody stomach, a few symptoms of swim stress induced ulcer, have been controlled drastically by the two polysaccharides, at a particular concentration.

Both the above peptic polysaccharides also exhibit inhibition of proton-potassium ATPase activity, while the ginger component arrested the growth of *H. pylori*, at suitable concentrations. Galectin, purified from the urine of cancer patients by ammonium sulfate precipitation, followed by gel filtration and affinity column chromatography, has been used to raise polyclonal antibody. Histopathological analysis has revealed that the incidence of lobular carcinoma being higher, the release of galectin from the epithelial cells may be essential for the

detachment of primary cancer cells leading to invasiveness.

The aggregation kinetics of synuclein, a 140 amino acid protein involved in neurodegenerative pathways in Parkinson's disease, have been studied using thioflavin-t and transmission electron microscope. An algorithmic computational model has been developed to understand the aggregation. Curcumin-glucoside, a water-soluble molecule, has been found to prevent synuclein aggregation. A film made with polyhydroxyalkanoate obtained by cultivation of *Rhizobium meliloti*, on sucrose medium, has exhibited water vapour transmission rates comparable to polyester and polypropylene films. Blending polyvinyl acetate with PHA has resulted in linear decrease in tensile strength and a linear increase in percentage elongation of PHA blends. It is found feasible to obtain a film ideal for forming and heat-sealing by blending these in an appropriate ratio. Aerobic degradation of PHA, under composting conditions, has been investigated. Exopolysaccharide production by the isolates of *Leuconostoc* sp. CFR2181 and *Lactobacillus* sp. CFR2182, has been studied. Glucose is found to be the major sugar in both the samples. Fruits of different cultivars of tomato collected at different stages of growth have been analyzed for their lycopene, total carotenoid, total soluble solids and ascorbic acid at different stages of maturity. Based on lycopene content, one of the cultivars, *Arka Ahuti*, has been identified for further studies.

The effect of hyperglycemia on total glutathione,  $\alpha$ -tocopherol and succinate dehydrogenase activity in testis, has also been determined. Formation of ROS and TBARS, at significantly elevated levels, has been observed in both testis and liver, associated with marked perturbations in the activity of various antioxidant enzymes. The data collected suggest that under experimental diabetic conditions, testicular mitochondria are subjected to oxidative stress.

Methods developed for determination of caffeine in non-alcoholic beverage and mixture of artificial sweeteners in beverages are under validation. A reverse phase HPLC method has been developed for detection of neurotoxin present in *Kesari dal* (*Lathyrus sativus*). Uric acid has been determined in turmeric samples following removal of curcumin. The method of estimation of thiamine in amylase rich energy food is being validated. Studies are in progress to prevent milk spoilage by intercepting signal molecules by homogenate furanones. The best estimated threshold for cardamom aroma has been determined in three different media. Volatiles present in vanilla extracts, pepper powders, pepper oleoresin and pepper essential oil were identified by GC-MS. Best estimated threshold for cardamom aroma (green, bold variety) was determined in three different media.

*D. hamiltonii* was subjected to sequential extraction using different solvents, such as hexane, ethyl acetate, acetone and methanol. Insecticide activity of ethyl acetate extract was found to be maximum



against adults of lesser grain borer, *Rhizopertha dominica*, through contact bioassay. Hexane extract was found to effectively inhibit the growth of *A. flavus*. Three plant materials that can inhibit feeding on blood meal in female mosquitoes, when burnt as coils, were identified. Conditions were standardized for analysis of quinalphos by GC chemicals and mixtures were screened to arrive at a standard method for decontamination of surface residues of quinalphos on fruits and vegetables. Protocols were prepared and standardized to maintain bacteria as well as worm cultures of *Caenorhabditis elegans* in agar and in liquid medium. Methods were standardized to identify the various life stages of the worms. Multipesticide analysis method, using single internal standard, was developed and statistically evaluated. Analytical methods for residues of pesticides as well as antibodies by LC-MS/MS were standardized. The Dot-ELISA kit for aflatoxin B1, developed in-house was validated. Groundnuts, maize, chilli powder, animal feed, wheat and soy flour formed the matrices. ELISA for invisible insect contamination, during storage, was found to be sensitive at a very small dose of antigen. The efficacy of disinfectant solutions prepared from ecofriendly ingredients in reducing the microbial load in cold environments was determined.

Mini dal mill, developed by CFTRI for dehulling bolder pulses, is being improved to enable dehulling of other pulses. Necessary changes in operational parameters and structure of the mill have been incorporated. A prototype of the improved mill has been fabricated. Based on trials, operational parameters for different pulses are being optimised. This mill, when made ready, is likely to be useful in households in the pulse growing regions of the country.

### CLRI-Scigenics MoU for Enzymatic Fermentation Facility



Exchange of agreement documents between CLRI and Scigenics India

**T**HE Central Leather Research Institute (CLRI), Chennai, has signed an agreement with M/s Scigenics India Pvt.Ltd, Chennai, for supply, installation, commissioning and operation and maintenance for upscaling of **Enzymatic Fermentation Facility** under the NMITLI programme. The total contract value including Q & M is Rs 2.02 crore. The agreement was signed on 3 May 2007 in the office of the Director, CLRI.



The CLRI and M/s Scigenics teams after signing the agreement



## Functional delivery of a cytosolic tRNA into mutant mitochondria of human cells

Many maternally inherited and incurable neuromyopathies are caused by mutations in mitochondrial (mt) transfer RNA (tRNA) genes. Kinetoplastid protozoa, including *Leishmania*, have evolved specialized systems for importing nucleus-encoded tRNAs into mitochondria.

B. Mahata, S. Mukherjee, S. Mishra, A. Bandyopadhyay and S. Adhya of the Indian Institute of Chemical Biology, Kolkata, in their research publication in *Science* (2006, Vol 314, Iss 5798, pp 471-474) have reported that the *Leishmania* RNA import complex (RIC) could enter human cells by a caveolin-1-dependent pathway, where it induced import of endogenous cytosolic tRNAs, including tRNA(Lys), and restored mitochondrial function in a cybrid harboring a mutant mt tRNA(Lys) (MT-TK) gene. The use of protein complexes to modulate mitochondrial function may help in the management of such genetic disorders.

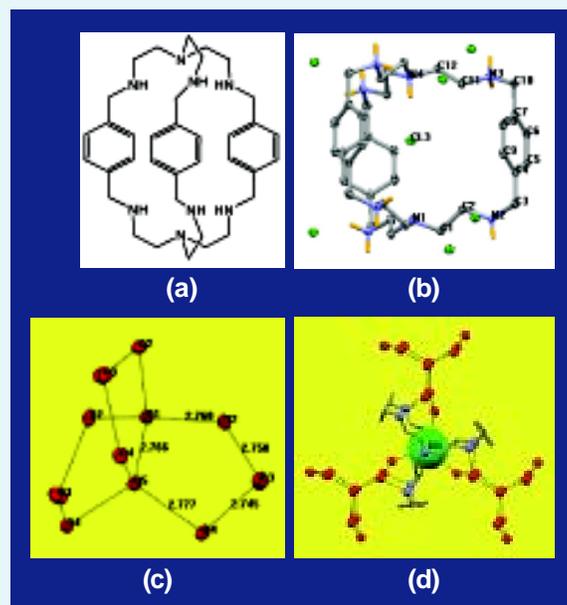
This is the first time a large protein complex has been shown to correct respiratory defects due to mitochondrial mutations that occur in certain human genetic disorders.

## Formation of Hybrid Water-Chloride Structure with Discrete Undecameric Water Self-Assembly in a Heptaprotonated Octaamino Cryptand

SMALL water clusters are subject of considerable theoretical and experimental interest in science for understanding the structure of bulk water. In the past several years, studies on structural morphologies of water cluster in crystal hydrates show that the stabilization of discrete even-membered water ring morphologies such as tetramer, hexamer, octamer, decamer, dodecamer, tetradecamer, and hexadecamer, are common within the lattice of crystal host. Curiously, little is known of the structural constraints required in stabilizing “discrete” odd-membered water cluster morphologies of “higher nuclearity” though trimers and pentamers are familiar in crystal hydrates.

P. S. Lakshminarayanan, E. Suresh, Pradyut Ghosh of the Central Salt & Marine Chemicals Research Institute, Bhavnagar, in their study published in *Angew. Chem. Int. Ed.* 2006, 45, 3807-3811, have utilized a homoditopic cryptand,  $N(\text{CH}_2\text{CH}_2\text{NHCH}_2\text{-}p\text{-xylyl-CH}_2\text{NHCH}_2\text{CH}_2)_3\text{N}$ , having N4 donor sets with xylyl spacers (a) in its heptaprotonated state (b) as a receptor for chloride encapsulation inside the proton cage.

Crystallographic analysis shows that the chloride encapsulated cage stabilized the structure of discrete propeller-shaped tricyclic water  $[(\text{H}_2\text{O})_{11}]$  clusters (c). This is the first report of a “discrete” propeller-shaped undecameric water cluster. This water cluster, oriented symmetrically around the cryptand moiety, interacts with the encapsulated chloride inside the cryptand cavity, forming the hybrid water-chloride structure (d).



(a) Octaamino cryptand; (b) ORTEP diagram of heptahydrochloride salt of octaamino cryptand; (c) ORTEP diagram of  $(\text{H}_2\text{O})_{11}$  cluster; (d) Encapsulated chloride and its interaction with the three discrete  $(\text{H}_2\text{O})_{11}$  clusters



### Seminar on Fibre Optic Sensor Technology for Real-time Monitoring of Parameters for Capacity Enhancement of Existing Transmission Lines

A one-day seminar on 'Fibre Optic Sensor Technology for Real-Time Monitoring of Parameters for Capacity Enhancement of Existing Transmission Lines' was held at the Central Glass & Ceramic Research Institute (CGCRI), Kolkata, on 12 April 2007. The seminar marked the conclusion of an international project that was awarded to CGCRI under Indo-Norwegian Programme of Institutional Cooperation (INPIC). The Norwegian counterpart was SINTEF- Norway. The main objective of the collaborative programme was to develop a Fibre Bragg Grating (FBG) based device for application of real time monitoring systems to measure conductor temperature, sag and tension in the critical spans of high tension transmission lines to enhance power flow capacity in hilly/coastal region in India. The project started in April 2005 with Power Grid Corporation of India as the user agency.

When the current flow enhances in power lines, the temperature of the conductor increases and as a result in worst cases the lines may permanently fail owing to thermal strain induced elongation. Therefore it is necessary to monitor the temperature rise on high tension conductor. Optical fiber technology has inherent advantage in such environment because of its immunity to electromagnetic fields and the possibility of transferring signals



Shri P.L. Narayana, Chief, Monitoring Unit, INPIC, delivering his address during the seminar. Others seated are: Dr Rajendra Prasad, Dr Lief Jerkan and Dr H.S. Maiti

over long distances. The developed sensor devices are wavelength selective temperature monitoring systems. The selectivity is altered by strain and temperature. Therefore by measuring the change in wavelength selectivity or shift, strain or temperature can be directly obtained.

The major achievements of the collaboration are: (i) Suitable photosensitive fibres for writing fibre Bragg-grating were developed at CGCRI, (ii) Design and modeling of FBG sensors suitable for temperature sensing were done jointly by CGCRI and SINTEF, (iii) Several FBG sensors were fabricated as per the design requirement at CGCRI and their temperature sensitivity was measured at different current level

at SINTEF, Norway and (iv) Suitable sensor probe and housing to install the sensor on high voltage conductor were also designed and fabricated at SINTEF. Combination of these accomplished tasks led to the development of sensor system and the first system was tested on ACSR (Moose) conductor in a laboratory test bed at SINTEF, Norway with low voltage and variable current strength up to 750 A.

After successful laboratory testing, the sensor housings have been installed on a 400KV power transmission line at Subhashgram substation of the user agency, Power Grid Corporation of India. The substation is situated in South 24-Parganas district in West Bengal. The sensor housings were

installed at two different locations close to one of the towers of the same conductor enabling monitoring of temperature of the same conductor at two different points simultaneously. The on-line data logging system is directly connected with the sensors using a special fibre-optic cable. The interface software for data logging was initiated by SINTEF and later on modified at CGCRI for final application according to the requirement. On line temperature recording is going on from the remote control room of Power Grid's substation. The results of these tests have been found excellent.

At the outset of the one-day seminar, Dr H. S. Maiti, Director, CGCRI, welcomed the guests, participants and team members of Fibre Optics Lab and expressed his happiness over the successful completion and demonstration of FBG sensors developed under the project. He said that the country would benefit from the said technology and hoped that the cooperation between CGCRI and SINTEF would continue in future. He expressed his sincere thanks to INPIC for extending cooperation and support. He also thanked SINTEF, Norway and Powergrid Corporation of India for actively participating in the programme.

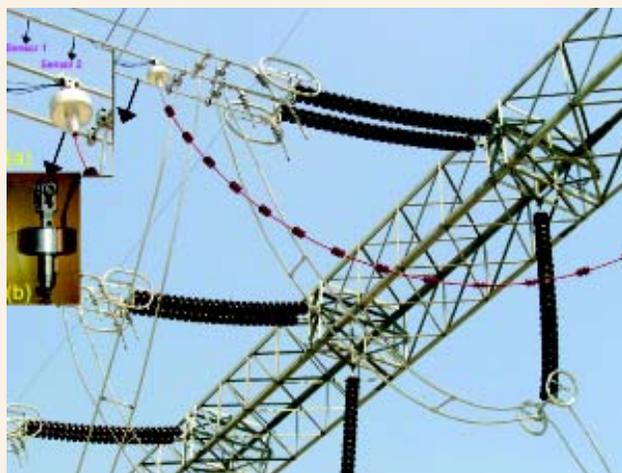
Shri P. L. Narayana, Chief of the Monitoring Unit, INPIC, also expressed his happiness over the successful completion of the project within stipulated time and

stated that the project had built a level of trust and confidence on the basis of which both sides benefited mutually. Dr Rajendra Prasad, Head, ISTAD, appreciated the proper utilization of allotted funds which had equipped CGCRI's Fibre Optics laboratory with the state-of-the-art facilities for fabrication and characterization of optical fibre. He hoped that such a collaborative project can create a platform for further exchange of ideas. He impressed upon the delegates the proactive role of CSIR in the collaboration. Shri S. K. Roy, Deputy General Manager and In-Charge, Power Grid Substation at Subhashgram, expressed his satisfaction over the functioning of temperature sensor installed at the site. He assured that user agency would extend all cooperation to continue this developmental work.

Dr Lief Jerkan, Senior Scientist, SINTEF, made an electronic

presentation of the work done by SINTEF in the project. He discussed the part of the work carried out in Norway and also the capabilities of FBG sensors in the measurement of vibration of high voltage transmission lines and related structures. This was followed by a presentation by Shri Kamal Dasgupta, Head, Fibre Optics, CGCRI. He discussed the uniqueness of FBG sensors in high voltage environment and said that the same idea could be extended to develop other varieties of FBG based sensors to monitor different parameters of high voltage transformers. Dr K. Ravisankar, Scientist F and Head, EML, SERC, Chennai, made a presentation of health monitoring of structure undertaken in SERC using fibre-optic sensor. He gave detailed description of Fibre Fabry-Perot (FFP) sensors and compared the same with new generation of FBG sensors. He remarked that remote monitoring of structures using GSM network had been tried out by SERC and the same knowledge base could be utilized for FBG based sensors if a proper interrogator was designed and developed.

The participants valued the work and expressed hope of similar collaborations in which SERC could be a vital partner in future. The meeting ended with a vote of thanks by Dr S. K. Bhadra., Scientist, Fibre Optics Section, CGCRI, Kolkata.



Installation of the FBG based temperature sensor system on 400 KV power conductor at Subhashgram substation of Power Grid Corporation of India. Insets: (a) Splice housing box with two mounted sensors on transmission line and (b) Enlarged view of Splice housing box



### Indo-German Workshop on Fuel Cells and Hydrogen Energy at CGCRI

**T**HE Central Glass & Ceramic Research Institute (CGCRI), Kolkata, organized **Indo-German Workshop on Fuel Cells & Hydrogen Energy** during 29-31 January 2007 at Kolkata, with the financial support of International Science & Technology Affairs Directorate (ISTAD), CSIR, India and Federal Ministry of Education and Research (BMBF), Germany. The aim of the workshop was to strengthen the research activities in this particular field with close interaction among the scientists of the two countries. The workshop was attended by around 75 participants including 11 from different centers of excellence in Germany, e.g., Forschungszentrum Jülich (FZJ), German Aerospace Centre (DLR), University of Karlsruhe (TH), Fraunhofer Institute of Technologies and Systems (IKTS), Forschungszentrum Karlsruhe, University of Hannover; RWTH Aachen University and EnBW Energie Baden-Württemberg AG. The participants from India represented from different premier R&D organizations including CSIR laboratories (CGCRI, NCL, CECRI, NAL, NML, CMERI, IMMT, IIP and CSIR HQ), BARC Mumbai, different IITs, RCI Hyderabad, NMRL, Ambernath and Center for Fuel Cell Technology, Chennai. In addition, BHEL and MNRE, Government of India, also participated.

The inaugural session was graced by the presence of Mr Wehrmann Günter, Consul General, German



Seen during the inaugural session of the workshop are: Dr H.S. Maiti, Dr Rajendra Prasad, Mr W. Günter, Dr D. Ströver and Dr R.N. Basu

Consulate, Kolkata. Welcoming his fellow German delegates and complimenting the organizers of the workshop, he expressed that the event was quite relevant under the present power scenario. In his welcome address, Dr H. S. Maiti, Director, CGCRI, greeted the delegates and distinguished guests and emphasized the importance of alternative/renewable energy sources to meet the future global energy needs and the necessity of developing co-operation programmes in this emerging field of research. Dr Maiti also briefed about the ongoing Solid Oxide Fuel Cell (SOFC) development programme under the NMITLI project for which CGCRI is the lead laboratory. He mentioned that a more elaborate programme in this area would be taken up by CGCRI

during the Eleventh Five Year Plan (2007-12). Dr Rajendra Prasad, Head, ISTAD, CSIR, spoke about the energy crisis that had become a global phenomenon and noted that international co-operation to solve the problem had been increasing globally. He emphasized on the use of hydrogen energy which gives harmless by-product, e.g. water and mentioned that Indian Government has already launched the Hydrogen Energy Road Map in which CGCRI, Kolkata, with this kind of initiative, could play a significant role. At the end of the inaugural session, Dr R.N. Basu, convener of the workshop and Head, Fuel Cell & Battery Section, CGCRI, proposed the vote of thanks and expressed his gratitude to all the delegates and sponsors of the workshop.

Twenty-two technical lectures



were presented by eminent scientists on diverse aspects of Fuel Cell Technology and production of hydrogen for use as an energy carrier and its storage.

The technical session began with the keynote address by Prof. Dr D. Ströver, Research Director, FZJ and leader of the German delegation. In his talk, Prof. Ströver covered the material aspects of planar SOFC and enumerated their influence on the performance of the cells. Dr R.N. Basu highlighted the current activity (under NMITLI Project) of CGCRI in developing state-of-the-art anode supported SOFC design using cost effective fabrication techniques. Dr S.K. Chopra, Principal Adviser and Special Secretary, MNRE, presented a brief international scenario on the present development on the use of different renewable energy sources vis-à-vis various programmes being undertaken by his Ministry. Prof. Ellen Ivers-Tiffée, Institute of Materials for Electrical Engineering, University of Karlsruhe, explained lucidly the novel electrochemical measurement techniques for characterizing the performance of SOFC. Prof. A. Michaelis, Managing Director of Fraunhofer Institute (IKTS, Dresden), emphasized the necessity of fuel cell technology development using cost effective manufacturing processes. Prof. J. Caro, Institute of Physical Chemistry and Electrochemistry, University of Hannover, in his lecture, highlighted the worldwide increasing R & D activity in the field of hydrogen selective membranes for hydrogen separation. Each of the technical lectures was followed by open discussions between the speaker and

the audience.

The workshop concluded with an interactive session to discuss future possible cooperative and collaborative programmes between the two participating countries on different fuel cells, hydrogen storage/generation and gas separation membranes. The session was chaired by Dr S. Sivaram, Director, NCL, Pune. Some of the key points that emerged as a result of this interactive session are: (i) Scientists from both the countries agreed to cooperate and collaborate in different aspects of fuel cell and hydrogen energy research, (ii) both the teams agreed to exchange visits of Scientists/Professors and students for which the necessary expenditure are to be organized through different existing Indo-German cooperative programmes, (iii) it was agreed to organize technical workshops on focused areas of common interest, preferably each year, alternately in India and Germany, (iv) related R & D activities in the individual countries will be mobilized through financial resources from their

respective ministries and/or industries and (v) research data of the collaborative programmes will be shared by the participating institutions and related IPR issues will be decided through joint consultations as and when appropriate. It was, in principle, decided that in India, CGCRI will coordinate research activities related to SOFC and gas separation, CECRI will coordinate activities on PMFC/DMFC and NCL will coordinate activities on hydrogen generation/storage.

Shri R.K. Bhattacharya, Executive Director, BHEL, opined that project demonstration under Indian conditions was very crucial even for a joint collaboration. In his concluding remarks Prof. Dr D. Ströver agreed, in principle, on the views expressed by representatives of both the countries for more interaction. He also expressed his heartfelt thanks and gratitude for the hospitality extended to his delegation during the workshop.



German Scientists visiting Fuel Cell & Battery Section of CGCRI, Kolkata



## Honours & Awards/Announcements

### Dr A. Ajayaghosh elected Fellow of Indian Academy of Sciences

DR Ayyappanpillai Ajayaghosh, a Scientist of the Photosciences and Photonics Group of the Chemical Sciences and Technology Division, National Institute for Interdisciplinary Science and Technology (NIST) (erstwhile Regional Research Laboratory), Thiruvananthapuram, has been elected a Fellow of the Indian Academy of Sciences, Bangalore, for the Year 2006.

Dr Ajayaghosh obtained his Bachelor's degree in Chemistry from Kerala University in the year 1982. After completing M. Sc. (1984) and Ph. D (1988) in Chemistry from Calicut University Chemistry Department, he joined the

Regional Research Laboratory, (presently NIST) as a Scientist. Subsequently he was an Alexander von Humboldt Fellow at the Max Planck Institut fuer Strahlenchemie, Muelheim an der Ruhr, Germany (1994-96) and a visiting faculty to many universities in Germany, Japan and The Netherlands. He is a recipient of the Young Scientist award of the Indian Science Congress Association (1988), Young Scientist Medal of the Indian National Science Academy (1991), Bronze Medal of the Chemical Research Society of India (2002). He is a member of the International Advisory Board of "Chemistry - An Asian Journal" published by Wiley-VCH,

Germany. His research interests are in the area of photonically and electronically active organic and macromolecular materials, particularly the supramolecular chemistry of functional dyes and  $\pi$ -conjugated systems, molecular self-assemblies and nanostructures, organogels, light harvesting assemblies and chemosensors. He is also an Adjunct Professor of the Material Research Programme of the Indian Institute of Technology, Kanpur.





# Nominations Invited

for

## CSIR Diamond Jubilee Technology Award 2007

**Cash Prize : Rs. One Million**

**An Annual award that seeks to recognize and honour outstanding technology development that has helped enhance India's competitiveness**

### Eligibility

- Any Indian team comprising members of Indian citizenship or
- Any company/organization with more than 50% of its shares owned by Indian citizens/entities
- Technology should have originated in India or if it has developed elsewhere, it should have significant Indian component

### Criteria

*A Technology that:*

- Creates a new market or significantly contributes to development of existing market and has benefited large cross-section of users and consumers
- Competes successfully in International market in terms of novelty, price, quality, functionality and reliability
- Helps raise capital and enhances brand equity or image of Company/Organization
- Promotes employment in the country
- Contributes to benefit of the community in general by raising the standards of quality of life.

### Application

Proposals for the Award may be sent in prescribed format before June 15, 2007. Format is available at the CSIR website <http://www.csir.res.in>



Complete application to reach:  
Head, Technology Networking and Business Development (TNBD) Division  
**COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)**  
Anusandhan Bhawan, 2 Rafi Marg,  
New Delhi-110 001  
Tel: 011-23717305, Fax: 011-23736842  
E-mail: [cdjta@csir.res.in](mailto:cdjta@csir.res.in)

## SIXTH CSIR DIAMOND JUBILEE INVENTION AWARD FOR SCHOOL CHILDREN (CDJIA-2007)

**C**OUNCIL of Scientific & Industrial Research (CSIR) is the premier Industrial R&D Organization in India. On the occasion of its Diamond Jubilee in 2002, CSIR initiated Invention Awards for school children to create awareness, interest and motivation for Intellectual Property amongst children.

On the occasion of the World Intellectual Property Day which is celebrated through out the world on 26 April, CSIR invites applications for the '**Sixth CSIR Diamond Jubilee Invention Award (CDJIA) for School Children**'. The first prize winner would also become eligible for WIPO's Young Inventor's Award carrying a medal and a certificate.

Applicant must provide the details of the invention submitted for the award in not more than 5000 words in English/Hindi including an abstract (in not more than 100 words), authenticated (by giving seal and date) and sent through the Principal/ Head of the School where the student is enrolled and personal details on a separate page as follows: Name, date of birth, school and residential address, class, telephone no. (residence/school) e-mail address.

In case of proposals already selected for state, national, international or equivalent awards, only the subject matter covering the improvements need to be submitted for consideration of CDJIA-2007.

Published inventions would be considered as per the provisions of the Patent Act.

The applications for the award not exceeding 5000 words in **English/Hindi** with requisite drawings will be considered. The write-up must describe the subject matter in a problem-solution mode and highlighting the novel and non-obviousness feature of the invention and its advantages.

Any Indian student enrolled in an Indian school below the age of 18 years as on 31st July 2007 can apply.

The invention submitted should be one that is globally novel, non-obvious and utilitarian. It could be a new concept or idea or a solution to an existing problem or completely a new method/ process/ device/ utility. It is not essential/ necessary that the invention should have been worked, only the concept of the invention should have been proved through a model, a prototype or experimental data. Details of any assistance/ guidance provided by teachers/parents/friends or others must be appropriately mentioned and acknowledged.

Typed applications to be sent by Registered Post/Courier to: Head, Intellectual Property Management Division, CSIR, NISCAIR Building, 14 Satsang Vihar Marg, Special Institutional Area, New Delhi - 110 067 with the envelope marked on top left hand corner 'CDJIA-

2007'. You may send application also by email: [head.ipmd@niscair.res.in](mailto:head.ipmd@niscair.res.in)

Applications received on or before 15th August 2007 will be considered for the Award.

**Prizes :** There are in all 60 prizes. Besides a certificate, the cash awards are:

First Prize (1 No.) Rs. 50,000/-

Second Prize (2 Nos.) Rs. 25,000/- each

Third Prize (3 Nos.) Rs. 15,000/- each

Fourth Prize (4 Nos.) Rs. 10,000/- each

Fifth Prize (50 nos.) Rs. 5,000/- each

The awardees will be selected by a high level Awards Selection Committee. If required, the short listed candidates may be called for Interview at Delhi or at any other appropriate place. The decision of the Awards Selection Committee / CSIR will be final and binding on the applicants and no enquiries/ correspondence in this regard will be entertained.

The Awards will be announced on CSIR Foundation Day, the 26th September 2007 at New Delhi and would be communicated to the Awardees only.

**For more information, please visit our site at [www.csir.res.in](http://www.csir.res.in)**



Recognizing and Honouring Outstanding S&T Innovation  
that has made a Visible Impact and Helped in  
Transforming Life in Indian Villages

## CSIR Invites Nominations

### ELIGIBILITY

- An Indian team or an organization or a company registered in India; and
- An S&T innovation that originated or has been applied in India, with considerable Indian component.

### CRITERIA

The Award would recognize an S&T innovation that has :

- Created a paradigm shift in standards of quality of life or alleviated the drudgery of the rural people;
- Demonstrated competitive advantage and positive user response;
- Helped in generation of rural employment in the country; and
- Shown a new way of conducting business to achieve social and economic transformation in the domain of rural development.

### The Award

Cash prize of Rupees 10 lakh,  
a citation and a plaque

### APPLICATION

Nominations for the Award in prescribed format may be sent before June 15, 2007.

Format is available at  
CSIR website - <http://www.csir.res.in>

Complete application to reach

Head  
Technology Networking and Business  
Development (TNBD) Division



### COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

Anusandhan Bhawan, 2 Rafi Marg, New Delhi - 110 001  
Tel : 011-23717305 Fax : 011-23736842  
E-mail: [caird@csir.res.in](mailto:caird@csir.res.in)

Printed and Published by S.K. Rastogi on behalf of National Institute of Science Communication and Information Resources (CSIR),  
Dr K.S. Krishnan Marg, New Delhi -110 012 and printed at NISCAIR Press, Dr K.S. Krishnan Marg, New Delhi -110 012  
Editor: Dr B.C.Kashyap; Associate Editors: Meenakshi; Vineeta Singhal; Editorial Assistant: Neelima Handoo;  
Design: Pradip Banerjee; Sarla Dutta; Production: Kaushal Kishore

Phone: 25846301 Fax: 25847062 E-mail: [bck@niscair.res.in](mailto:bck@niscair.res.in); [meenakshi@niscair.res.in](mailto:meenakshi@niscair.res.in); [vineeta@niscair.res.in](mailto:vineeta@niscair.res.in); Website:<http://www.niscair.res.in>  
For subscription: The Sales & Distribution Officer, NISCAIR; E-mail: [sales@niscair.res.in](mailto:sales@niscair.res.in) Annual Subscription: Rs 300 Single Copy: Rs 15.00  
Subscription Complaint No 25843359